Faculty of Life Sciences

JSS ACADEMY OF HIGHER EDUCATION & RESEARCH
(DEEMED TO BE UNIVERSITY) MYSURU

JSS Academy of Higher Education & Research

(Deemed to be University)

Re-Accredited "A+" Grade by NAAC

Sri Shivarathreeshwara Nagara Mysuru - 570015, Karnataka

Syllabus

M.Sc. GEOINFORMATICS

As per UGC's Learning Outcome Based Curriculum Framework (LOCF) under the CBCS pattern

Implementation Year 2021-22 onwards

MSc

Syllabus

M.Sc. Geoinformatics

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M.Sc. Geoinformatics

CONTENTS

M.Sc. Geoinformatics

FOREWORD

The Division of Geoinformatics was set up in the year 2014 with an emphasis of enhancing and providing quality interdisciplinary education in the field of Spatial Sciences. We have experienced faculty members, who are at the foremost of diverse fields that span the frontiers of research in Spatial Sciences and the discovery in the current scenario. We are offering M.Sc. Geoinformatics encompassing components of GIS, Remote Sensing, GNSS and Photogrammetry.

Our post graduate program is vibrant and thriving and provides outstanding platform to successfully launch into diverse career paths. Division carry out research with the emphasis on Regional Planning, Health GIS, Watershed Management and Climate Change. Geoinformatics laboratory has infrastructure facilities for carrying out research work in the field of GIS, Remote Sensing, GNSS and Photogrammetry.

The Division of Geoinformatics is recognised as a nodal center for IIRS Outreach Programme which focuses on strengthening the Academia and User Segments in Space Technology & Its Applications using Online Learning Platforms (EDUSAT).

DIVISION OF GEOINFORMATICS

School of Life Sciences

JSS Academy of Higher Education & Research, Mysuru-570017 (India)

Institute Vision

"To provide education that helps transformation of individuals and society"

Institute Mission

The Mission of JSS Academy of Higher Education & Research is to expand the boundaries of education and to make the most amazing learning possible by:

- Providing superior undergraduate, graduate and professional education to its students.
- Developing and advancing the talents of students to create applicable knowledge.
- Nurturing translational and transformational research that benefit the society.
- Inspiring to excel in health sciences delivery and care

Division of Geoinformatics Vision, Mission and Values

Division Vision

To be the Centre of Excellence for teaching, training, research, and application of Geospatial Technology to answer the spatial problems for sustainable development.

Division Mission

- To provide a strong theoretical and practical background across the Geospatial Technology discipline and train students to effectively apply this education to solve real-world problems.
- To produce successful graduates with personal and professional responsibilities and commitment to lifelong learning.
- Conduct research to advance the state of the art in Geospatial Technology and integrate research results and innovations into other scientific disciplines

We aspire to values which are based on the highest professional, research and academic standards in terms of personal growth and satisfaction offered to our students, growth, and excellence in learning. growth and satisfaction imparted to our students, as well as growth and quality in learning.

GRADUATE ATTRIBUTES

The Graduate Attributes are the knowledge skills and attitudes which the students have at the time of graduation.

Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of multiple disciplines as a part of Geospatial Technology that helps students to achieve comprehensive integrated knowledge.

1. **Interdisciplinary Knowledge:** Apply the knowledge of Science, computer science, and Earth Sciences specialization to the solution of complex real world spatial problems.
2. **Critical thinking**: Capability to apply spatial analytic thought to a body of knowledge; analyze and critically evaluate spatial problems that helps students to create the spatial decision making.
3. **Problem solving**: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar spatial problems, rather than replicate curriculum content knowledge.
4. **Research Skill**: Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of Geospatial Technology.
5. **Usage of modern tools**: Create, select, learn and apply appropriate techniques, resources, and modern computer engineering tools, including prediction and modeling, to complex spatial activities with an understanding of the limitations.
6. **Scientific reasoning**: Ability to analyze, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences
7. **Information/digital literacy**: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
8. **Project Management**: Demonstrate knowledge and understanding of project management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.
9. **Moral and ethical awareness/reasoning:** Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behavior.

DIVISION OF GEOINFORMATICS

M.Sc. GEOINFORMATICS

Programme Educational Objectives (PEOs)

PEO 1	To prepare the students in identifying, analyzing and solving geospatial problems.
PEO 2	To train the students in developing practical and executable solutions to the challenges of growing field of Remote Sensing and GIS.
PEO 3	To impart the students with strong base of knowledge that makes them suitable both for industries as well as for teaching and research.
PEO 4	To inculcate the students with the sensitivity towards ethics, public policies and their responsibilities towards the society.

PROGRAM OUTCOMES (POs)

At the end of the program, the student will be able to:

PO 1	To train the students in developing practical and executable solutions to the challenges of growing field of Remote Sensing and GIS.
PO 2	Demonstrate higher level of professional skills to tackle multidisciplinary and complex problems related to "Remote Sensing and GIS".
PO 3	An ability to independently carry out research /investigation and development work to solve real world geospatial problems.
PO 4	Evaluate and create geospatial models and tools to address complex spatial problems
PO 5	An ability to share theoretical and practical knowledge in both teaching and research as well as in industries.

M.Sc. GEOINFORMATICS PROGRAM STRUCTURE 2021-2023

S.N	Course Type	Title of the Course	Hrs/ Week	Examination				Total Credit
				Duration in Hours	CIA	Sem Exam	Max. Marks	
SEMESTER I								
1	DSC-01	Principles of Remote Sensing	4	3	30	70	100	4
2	DSC-02	Geographic Information Systems	4	3	30	70	100	4
3	DSC-03	Basics of Computer Programming	4	3	30	70	100	4
4	AECC	Principles of Statistics	2	2	-	50	50	2
5	SEC -01	Global Navigation Satellite System	2	2	-	50	50	2
6	Practical-01	Techniques of Spatial Data Interpretation	4	3	15	35	50	2
7	Practical-02	Practical in Spatial Data Processing	4	3	15	35	50	2
Total Marks and Credits							**500**	**20**
SEMESTER II								
1	DSC-04	Satellite Image Processing	4	3	30	70	100	4
2	DSC-05	Introduction to Spatial Data Analysis	4	3	30	70	100	4
3	DSC-06	Python Programming	4	3	30	70	100	4
4	DSE-01A Or DSE-01B	Photogrammetry (Or) Advanced Surveying	4	3	30	70	100	4
5	DSE-02A Or DSE-02B	Spatial Database Management (Or) Spatial Statistics	4	3	30	70	100	4
6	SEC-02	Open Source GIS	2	2	-	50	50	2
7	Practical-03	Practical in Satellite Image Processing	4	3	15	35	50	2
8	Practical-04	Practical in Geospatial Analysis	4	3	15	35	50	2
Total Marks and Credits							**650**	**26**
SEMESTER III								
1	DSC-07	Advanced Remote Sensing	4	3	25	75	100	4
2	DSC-08	Advanced GIS and Modelling	4	3	25	75	100	4
3	DSC-09	Geoinformatics for Natural Resource Management	4	3	25	75	100	4
4	DSE-03A Or DSE-03B Or DSE-03C	Geoinformatics for Hydrology (Or) Web GIS (Or) GIS for Public Health	4	3	25	75	100	4
5	SEC-03	GIS Project Management	2	2	-	50	50	2
6	Practical-05	Advanced Geospatial Analysis	4	3	15	35	50	2
7	Practical-06	Programming for GIS	4	3	15	35	50	2
8		Summer Internship	-	-	-	-	50	2
Total Marks and Credits							**600**	**24**
SEMESTER IV								
1		Research Project					300	12
Total Marks and Credits (Semester I to IV)							**2050**	**82**

Semester One

SEMESTER - I

DSC-01: PRINCIPLES OF REMOTE SENSING

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSC	DSC 01	56		4	0	0	4

Pre-requisite(s): Basic laws of Physics

Course Objectives:

This course aims to:

1.	Attain a foundational knowledge and comprehension of the physical, computational, and perceptual basis for Remote Sensing
2.	Train the students for retrieval of earth surface features using multi-resolution, multi-scale and multi-temporal imagery
3.	Enable spatial and temporal thinking to relate remote sensing for real-world applications.
4.	Create a firm basis for successful integration of remote sensing in any field of application

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Enhance understanding of fundamental physical principles of Remote Sensing.
CO2	Recognize and explain basic computational properties of Remote Sensing data acquisition, storage, and processing.
CO3	Identify key applications of land, marine, aquatic, and atmospheric Remote Sensing.
CO4	Understand the process of data reception and the type of data products.

SYLLABUS

Topics	Lectures
UNIT-1 PHYSICS OF REMOTE SENSING	
Concept & Principles, Definition, chronological development, Electromagnetic Spectrum, Electromagnetic Radiation (EMR), Wavelength Regions, and their Significance. Interaction of EMR with Atmosphere, Atmospheric Window. Interaction of EMR with Earth's Surface, Spectral Reflectance Curve. Types of Remote Sensing.	**14**
UNIT-2 SATELLITES AND SENSORS	
Remote Sensing Sensors and Platforms, Satellite Characteristics: Orbits: Geo-Synchronous and Sun-Synchronous, Swaths. Scanning Methods, FOV and IFOV. Image Resolutions: Spectral, Spatial, Temporal and Radiometric resolutions. Image Data Characteristics, Data Selection Criteria.	**14**
UNIT-3 REMOTE SENSING SATELLITES	
Orbit, sensor characteristics and applications of Weather satellites: GOES, NOAA, METEOSAT, INSAT. Land observation satellites: LANDSAT, SPOT, IRS, Sentinel, IKONOS, GEOEYE, WORLDVIEW. Marine observation satellites: Seasat, Nimbus: CZCS, MOS, SeaStar: SeaWiFS, Oceansat.	**14**
UNIT-4 DATA RECEPTION AND DATA PRODUCTS	

Ground Segment Organization, Introduction to Data Product, Index Numbers for data products, Types of Data Products, Digital Image Data Formats: BIP, BIL, BSQ. Placing an Order for a Data Product, Open Data Sources, True Colour Composite (TCC) and False Colour Composite (FCC) images and its applications	**14**

REFERENCES:

1. George Joseph & C Jeganathan (2018). Fundamentals of Remote Sensing, 3th Edition, The Orient Blackswan.
2. Jensen, J.R., (2013). Remote Sensing of the Environment – An Earth Resources Perspective, 2nd edition, Pearson Education, Inc. (Singapore) Pvt. Ltd., Indian edition, Delhi.
3. Lillesand, Thomas M. and Kiefer, Ralph, W., Chipman Jonathan (2015), Remote Sensing and Image Interpretation, 7th Edition, John Wiley and Sons, New York.
4. Reeves, R. G. (1991). Manual of Remote Sensing, Vol. I, American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, USA.
5. Sabins, F.F. Jr. (2007). Remote Sensing: Principles, Interpretation, & Applications, 4th Ed, Waveland Pr Inc.

REFERENCE WEBSITES:

1. https://www.nrcan.gc.ca
2. https://www.nrsc.gov.in
3. http://geoinfo.amu.edu.pl/wpk/rst/rst/Front/tofc.html
4. https://www.isprs.org/education/tutorials.aspx

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSC-02: GEOGRAPHIC INFORMATION SYSTEMS

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSC	DSC 02	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Introduce the basic concepts of GIS and familiarize with the spatial and non-spatial data models
2.	Understand the basic concepts and procedure of the GIS data capturing and editing.
3.	Understand and create the concept of database management system and its application in GIS.
4.	Provide expected knowledge and skills as well as the expertise for spatial data analysis.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand and differentiate GIS and Cartography, spatial vs. non-spatial data models.
CO2	Explain the data input methods, geo-corrections, components, functionality of a GIS.
CO3	Understand and Create GIS data models
CO4	Create and manage a Geodatabase for effective spatial analysis and querying.

SYLLABUS

Topics	Lectures
UNIT-1 INTRODUCTION	
Definition, History and development of GIS, Components of GIS, capabilities and purpose of GIS, Applications of GIS. GIS and Cartography, Basics of Cartograpy: Map and its classification, Map Scale, Coordinate Systems -Latitudes and Longitudes– Datum, Geographical Coordinate Systems, WGS84, Projected Coordinate System, UTM.	**14**
UNIT-2 GIS DATA MODELS	
Spatial and attribute data, Basic spatial entities, Spatial data models – Raster and Vector: Comparison, Advantages and limitations. Raster and Vector spatial data structures, Raster data compaction techniques, Data Conversion and Integration: Rasterization & Vectorization, Modelling Surfaces: Raster and Vector Approach, Modelling Networks, Modellng 3D and 4D, Overview of GIS Software Packages	**14**
UNIT-3 DATA INPUTS AND GEO-CORRECTIONS	
GIS Data Sources: Existing hard copy Maps, Survey Data, GPS Data, Text Files. Remotely Sensed data. Methods of Data Input: Keyboard Entry, Manual digitizing, Automatic digitizing, Electronic data transfer. Data Editing: Type of errors, Detecting and correcting errors, Topology, Re-projection. Geometric Transformation: types and Root Mean Square (RMS) error, Edge matching and rubber sheeting, Geocoding address data	**14**
UNIT-4 DATABASE MANAGEMENT SYSTEM	

The database approach, Database management systems. Database Models: Hierarchical, Network, Relational, Object oriented database Model. Integrated Database, Linking spatial and non-spatial data, GIS Database.	**14**

REFERENCES:

1. Burrough, P. A., McDonnell, R. A. and Lloyd C. D. (2016): Principles of Geographical Information Systems, Oxford University Press, New York, 3rd edition.
2. C.P. LO and Albert K.W. Yeung (2016) Concepts and Techniques of Geographic Information Systems, Pearson Education; 2nd edition.
3. Ian Heywood, Sarah Cornelivs and Steve Carver (2015) An Introduction to Geographical Information System, Pearson Education Pvt .Ltd., New Delhi, 4th edition.
4. John Jensen, Ryan Jensen (2017) Introductory Geographic Information Systems, Pearson Education; First edition.
5. Kang-Tsung Chang (2020) Introduction to Geographic Information Systems, McGraw Hill; Ninth Edition.

REFERENCE WEBSITES:

1. https://www.gislounge.com/
2. https://www.esri.com/en-us/what-is-gis/overview
3. https://gisgeography.com/
4. ttps://ncog.gov.in/

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSC-03: BASICS OF COMPUTER PROGRAMMING

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSC	DSC 03	56		2	0	2	4

Pre-requisite(s): Basic laws of Physics

Course Objectives:

This course aims to:

1.	express algorithms and draw flowcharts in a language independent manner.
2.	each how to write modular, efficient and readable C programs.
3.	Describe the techniques for creating program modules in C using functions & recursive functions.
4.	familiarize pointers and dynamic memory allocation functions to efficiently solve problems.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Write, compile and debug programs in C language.
CO2	Use different data types in a computer program
CO3	Design programs involving decision structures, loops, arrays and functions.
CO4	Use pointers to understand the dynamics of memory; create & perform different file operations.

SYLLABUS

Topics	Lectures
UNIT-1 INTRODUCTION	
Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. **Number Systems**: Binary, Octal, Decimal, Hexadecimal. **Introduction to C Language**: Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.	**7**
UNIT-2 CONDITION STATEMENTS AND FUNCTIONS	
Conditional Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, DoWhile and Examples. Continue, Break and Goto statements **Functions**: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing, Recursive Functions.. **Storage Classes**: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers	**7**
UNIT-3 ARRAYS AND POINTERS	

Arrays: Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort. **Pointers**: Introduction (Basic Concepts), pointers to pointers, compatibility, Pointer Applications, Arrays and Pointers, Pointer Arithmetic, memory allocation functions, array of pointers, pointers to void, pointers to functions, command –line arguments, Introduction to structures and unions.	**7**
UNIT-4 STRINGS AND STRINGS	
Strings: Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions. **Input and Output**: Introduction to Files, Modes of Files, Streams, Standard Library Input/ Output Functions, Character Input/Output Functions.	**7**

REFERENCES:

1. B.A. Forouzan and R.F. Gilberg, "A Structured Programming Approach in C", Cengage Learning, 2007
2. Kernighan BW and Ritchie DM, "The C Programming Language", 2nd Edition, Prentice Hall of India, 2006.
3. Rajaraman V, "The Fundamentals of Computer", 4th Edition, Prentice-Hall of India, 2006.

REFERENCE WEBSITES:

1. https://www.nrcan.gc.ca
2. https://www.nrsc.gov.in
3. http://geoinfo.amu.edu.pl/wpk/rst/rst/Front/tofc.html
4. https://www.isprs.org/education/tutorials.aspx

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

AECC: PRINCIPLES OF STATISTICS

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
AECC	AECC	28		2	0	0	2

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Train the students intensively in both theoretical and practical aspects of statistics.
2.	Bring them in contact with basic concepts and methods .
3.	Create a problem-solving attitude with the aid of statistical methodology.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Apply to construct frequency distribution and graphical methods.
CO2	To calculate and apply measures of location and measures of dispersion.
CO3	Perform Test of Hypothesis and understand the concept of p-values

SYLLABUS

Topics	Lectures
UNIT-1 DESCRIPTIVE STATISTICS	
Importance and Scope of Statistics, Data Types, Variables, Frequency Distribution, Graphical Representation Methods (Histogram, Bar Charts, Pie Charts), Measures of Center Tendency (Mean, Median, Mode,) and Dispersion (Standard Deviation, Variance) Advantages and Disadvantages.	**7**
UNIT-2 PROBABILITY	
Basic Terminology: Trial, Events, Sample Space and Sample Points, Basic Laws of Probability, Types of Probability, Normal probability curve, Standard Normal Distribution, Bayes theorem - simple problems.	**7**
UNIT-3 SAMPLING METHODS	
Concept of Population, Sample, Sampling, Sample Size, Sampling Error, Advantages and Disadvantages of Sampling Method, Types of Random Sampling Methods – SRS, Stratified Random Sampling, Systematic Random Sampling and Cluster Sampling.	**7**
UNIT-4 TESTING OF HYPOTHESES	
Statistical Hypotheses-Null and Alternative, Level of Significance, Type I and Type II Error, P Value, Degrees of Freedom, Chi-Square Test, Student's t Test: One Sample t Test and Paired and unpaired t Test, Analysis of Variance. Correlation-Karl Pearson's and Spearman's rank correlation. Regression Analysis.	**7**

REFERENCES:

1. Fundamentals of Biostatistics. Veer Bala Rastogi. Publisher: ANE Books. 2nd Edition, 2009.
2. Fundamentals of Mathematical Statistics, S.C. Gupta and V. K. Kapoor, Publisher: Sultan Chand & Sons (2014).
3. Fundamentals of Statistics. S.C. Gupta. Publisher: Himalaya Publishing House Pvt. Ltd.Edition.7th Edition, 2012
4. Introductory Statistics for Biology. R. E. Parker. Publisher: Cambridge University Press 2nd Edition, 1991.
5. Statistics for behavioral science. Chintamani Kar. Publisher: Dominant Publishers & Distributors (P) Ltd. (2015).

REFERENCE WEBSITES:

1. https://online.stanford.edu/courses/xfds110-introduction-statistics
2. https://open.umn.edu/opentextbooks/textbooks/459

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

SEC-01: GLOBAL NAVIGATION SATELLITE SYSTEM

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
SEC	SEC 01	28		2	0	0	2

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	provide students with advanced skills and knowledge in the field of GNSS.
2.	relates real-time applications, to prepare them to enter the highly dynamic GNSS and GNSS-dependent industry.
3.	demonstrate a clear understanding of the GPS signal, codes and biases.
4.	describe the differences between relative and autonomous GPS positioning, code phase carrier phase, DGPS and RTK.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand concepts and Working principles of GNSS
CO2	Gain ideas about GPS'S Satellite geometry and GPS coordinate system.
CO3	Know Geodesy and Surveying and It's Measuring techniques and Pre survey preparations.
CO4	Acquire ideas on GNSS Applications in Navigation, Tracking, Mapping and Tinning.

SYLLABUS

Topics	Lectures
UNIT-1 INTRODUCTION	
Historical development - - Services and Segments of GPS system, GLONASS, Galileo, Regional Navigation Satellite Systems (RNSS), GAGAN, IRNSS systems, Augmentation Systems.	**7**
UNIT-2 WORKING PRINCIPLES	
Satellite ranging - resection; error sources atmospheric - Ionospheric errors – multipath - Selective availability - antispoofing error rectification - atmospheric and Ionospheric models –choke ring - differentially corrected positions; Positioning techniques - precise point positioning; - Satellite geometry - mask and azimuth angles.	**7**
UNIT-3 GEOESY AND SURVEYING	
Geodesy - meaning and application - GNSS – GPS coordinate system – Local Coordinate system – transformations – step wise transformation – seven parameter transformation; Measuring techniques – Static surveys –- rapid static survey – kinematic survey – RTK survey – Pre survey preparations – Total Station, GIS and GPS data integration.	**7**
UNIT-4 GNSS APLICATIONS	
Location - Navigation - Tracking - Mapping and Tinning - Misuses of GNSS - types of misuses - examples - Intelligence collection augmentation with weapon system, integration into ballistic and cruise missile systems; Future uses – position information society -consumer based GNSS products.	**7**

REFERENCES:

1. Hofmann – Wellenhof, Lichtenegger, and Wasle, (2008). Global Navigational Satellite Systems (GNSS) Springer Wien New York.
2. Agraval, N. K., (2006). Essentials of GPS, Geodesy and GPS publications, Hyderabad.
3. Awange, J. L., (2012). Environmental Monitoring using GNSS: Global Navigation Satellite Systems, Springer, London.
4. Jan Van Sickle, (2008). GPS for Land Surveyors, CRC Press, Taylor & Francis Group, New York.
5. NelSamama, (2008). Global Positioning Techniques and Performance, John Wiley and Sons, Inc., New Jersey.
6. Ganesh, A., (2006). Dimensions of Geomatics, Bharathidasan University, Tiruchirappalli.
7. Ganesh, A., and Narayana Kumar, R., (2006). GPS Principles and Applications,Satish Serial Publishing House, Delhi.

REFERENCE WEBSITES:

8. http://www.unoosa.org/pdf/icg/2013/Ed_GNSS_eBook.pdf
9. https://www.ion.org/publications/online-tutorial-intertial.cfm
10. https://www.novatel.com/an-introduction-to-gnss/

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

PRACTICAL 01: TECHNIQUES OF SPATIAL DATA INTERPRETATION

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
Practical	PRACT 01	56		0	0	4	2

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Introduce the fundamental knowledge of map and elements of map
2.	Teach skills in interpretation of Topographical maps, satellite images and aerial photographs.
3.	to teach downloading of satellite image for spatial data extraction,
4.	Provide expected knowledge and skills of GPS handling and ints integration with GIS.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand elements of SOI maps , its interpretation and uses.
CO2	Interprete, aerial photos, satellite images and their downloading process.
CO3	Handle instruments, tools, techniques and modeling while using analog images and maps.
CO4	Use GPS for the acquisition of the locational data and integration with GIS.

SYLLABUS

Lab No	Topics	Lectures
1	Topographical Maps: Introduction, Maps by Survey of India, marginal information of topographical maps -Signs and Symbols. Elements of image interpretation.	**6**
2	Interpretation of SOI Topographical Maps: Physical Features: Relief, Drainage , Vegetation.	**6**
3	Interpretation of SOI Topographical Maps: Cultural Features: Land use, means of communication and settlements	**6**
4	Introduction to Air Photos: Marginal information of air photo product,	**4**
5	Stereo Scope Viewing: Pocket stereoscope and Mirror stereoscope	**6**
6	Application And Map Making Through Air Photo: Visual interpretation keys, Interpretation of Aerial Photographs: Fluvial Geomorphology, Transport and settlements,	**6**
7	Satellite Image Information: True colour and false colour image, Satellite image Interpretation: Land use land cover, Geomorphology, Surface water.	**6**
8	Online Remote Sensing Data and Their Products: USGS Global Visualization Viewer (GloVis), NASA Earth Observation (NEO), USGS Earth Explorer, ESA's Sentinel data, NASA Earth Data, NOAA Class, IPPMUS Terra, LANCE, VITO Vision, Bhuvan, MOSDAC, India-WRIS.	**6**

9	Introduction to GPS and initial setting, Creating codes and attribute table for GPS receiver, GPS data collection for point, line and area calculation,	**6**
10	GPS and GIS integrations output preparation.	**4**

REFERENCES:

1. R. P. Mishra (2014). Fundamentals Of Cartography, Concept Publishing Company.
2. Singh, R. L. (1979). Elements of Practical Geography, New Delhi: Kalyani Publishers
3. Kenneth Field (2018). Cartography, Environmental Systems Research Institute Inc.,U.S.; 1st edition.
4. Ahmed, E. L., Rabbany (2002). Introduction to Global Positioning System. Boston: Artech House.

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

PRACTICAL 02: PRACTICAL IN SPATIAL DATA PROCESSING

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
Practical	PRACT 02	56		0	0	4	2

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Introduce practical understanding of GIS concepts, techniques and real world applications .
2.	Understand the basic concepts and procedure of the GIS data capturing and editing.
3.	Understand and create the concept of database management system and its application in GIS.
4.	Provide expected knowledge and skills as well as the expertise for spatial data analysis.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand and differentiate different GIS softwares and its products
CO2	Compile, analyze, and present geospatial data while emphasizing visual communication.
CO3	Basic geospatial concepts while working with ESRI's ArcGIS software.
CO4	Understand the basics of data capture, storage, analysis, and output in a GIS

SYLLABUS

Lab No	Topics	Lectures
1	Overview of the GIS softwares, Introduction to ESRI's ArcGIS: Software Products (Licensing Levels) – Components of ArcGIS Desktop: ArcMap, ArcCatalog, ArcGlobe, ArcScene and ArcGIS Pro – Extensions and other products.	**4**
2	Introduction to ArcGIS Applications: ArcMap, ArcCatalog, Working with ArcGlobe and ArcScene – Customizing the UI, interacting with maps and data – exploring online resources.	**4**
3	Georeferencing Data: Map coordinate systems – Map projections and types – Viewing Projection Information – Georeferencing a raster data, Reprojections and Transformations.	**5**
4	Building Geodatabases: Types of Geodatabases – Feature Dataset – Feature Class – Import of Data – Spatial Data Formats, Shape/Coverage Files and Layers.	**5**
5	Creating and Editing Data: Creating feature classes (Digitization) – Editing features – Topology Creation.	**8**
6	Attribute Data Input: Creation of Schema – Attribute Tables – Attribute Data Definition – Data Input – Attribute data Updating. Joining data by attribute – Relating data – Joining data by location – Calculating attribute values – Creating graphs.	**6**

7	Preparing Data for Analysis: Dissolving features – clipping layers – creating a data subset.	**4**
8	Displaying And Presenting Data: Symbolizing features – using styles and creating layer files – classifying features – Labelling Features – Symbolizing raster.	**4**
9	Making Maps for Presentation: Creating a layout: adding titles and additional text – Adding standard map elements – Adding final touches and setting print options.	**6**

REFERENCES:

1. Michael Law, Amy Collins (2018). Getting to Know ArcGIS Desktop, Esri Press.
2. Michael Law, Amy Collins (2020). Getting to Know ArcGIS Pro 2.6, Esri Press.
3. Wilpen L. Gorr and Kristen S. Kurland (2016). GIS Tutorial 1: Basic Workbook, Esri Press. 6th edition.
4. David W. Allen (2016). GIS Tutorial 2: Spatial Analysis Workbook, Esri Press.4th edition.
5. Gina Clemmer (2018). The GIS 20: Essential Skills, Esri Press.

REFERENCE WEBSITES:

1. https://learn.arcgis.com/en/
2. https://learn-arcgis-learngis.hub.arcgis.com/

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

< 34% = 1, 34-66% = 2, > 66% = 3

Semester Two

SEMESTER - II

DSC-04: SATELLITE IMAGE PROCESSING

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSC	DSC 04	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Describe and explain basic principles of digital image processing
2.	Get familiarized about various image enhancement and image processing techniques.
3.	Be familiar with image classification, Accuracy Assessment and Change Detection Techniques.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Know the Remote Sensing Process, Digital data, Data formats and Image processing system.
CO2	Obtain knowledge on Image Pre-processing, error detection and correction
CO3	Analyze images in the frequency domain using various transforms.
CO4	Get knowledge on Image Classification, Change Detection and Accuracy Assessment.

SYLLABUS

Topics	Lectures
UNIT-1 INTRODUCTION	
Steps in Digital Image Processing – Digital images: Data Products and their Characteristics –Digital image formation – Image Display Mechanism – Image Histograms – Look Up Table Data.	**10**
UNIT-2 IMAGE PRE-PROCESSING AND ENHANCEMENT	
Sources of Errors: Geometric, Radiometric and Atmospheric – Image Corrections: Radiometric Correction, Atmospheric Correction and Geometric Correction – Image Transformation – Ground Control Points – Re-sampling Techniques: Nearest Neighbor, Bilinear interpolation, Cubic Convolution. Contrast Enhancement: Linear, Non-Linear – Spatial Filtering: Spatial Convolution and the Fourier Transform. Multi-Image Enhancement: Band Ratioing, Principal Component Analysis (PCA), Vegetation Indices, Texture Transformations, and Image Fusion.	**16**
UNIT-3 IMAGE CLASSIFICATION TECHNIQUES	
NRSC Land-Use and Land-Cover Classification Scheme – Selection of Optimum Bands for Image Classification: Feature Selection – Supervised Classification: Training Site Selection and Statistics Extraction – Classification Algorithms: Parallelepiped, Minimum Distance, Nearest-Neighbour, Maximum Likelihood – Unsupervised Classification: Classification Algorithms: Chain Method, ISODTA Method – Fuzzy Classification – Object-based Image Analysis (OBIA) Classification.	**16**

UNIT-4 ACCURACY ASSESSMENT	
Steps to perform Accuracy Assessment – Sources of Error –The Error Matrix – Sample Size – Sampling Design – Evaluation of Error Matrices: Error of Commission and Omission, Kappa Analysis – Change Detection Analysis.	**14**

REFERENCES:

1. Lillisand T.M, R.W. Kiefer & Chipman (2015) Remote Sensing and Image Interpretation (7th edition). John Wiley & Sons, New York.
2. Jensen, J. R. (2016): Introductory Digital Image Processing: A Remote Sensing Perspective (4th Edition), Pearson Publication.
3. R.C.Gonzalas and R.E.Woods (2016): Digital Image Processing, Prentice Hall, 3rd Ed., Pearson India.
4. A.K.Jain (2015): Fundamentals of Digital Image Processing (1st Edition), Pearson Education India.
5. Prithvish Nag, and Kudrat, M., (1998). Digital Remote Sensing, Concept Publishing Company, New Delhi.
6. Paul Gibson, and Clare H. Power, (2000). Introductory Remote Sensing: Digital Image Processing and Applications, Routledge Publisher, London.
7. Richards, J. A., Jia, X. (2000): Remote Sensing and Digital Image Processing, Springer, Verlag Berlin.

REFERENCE WEBSITES:

1. https://onlinecourses.nptel.ac.in/noc19_ce38/preview
2. https://www.youtube.com/watch?v=hhddNZloKWs
3. https://www.iirs.gov.in/EDUSAT-News
4. https://youtu.be/H0MQ287871o

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSC-05: INTRODUCTION TO SPATIAL DATA ANALYSIS

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSC	DSC 05	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Describe the theoretical foundations of geospatial analysis
2.	Overview of an introduction to the range of statistical techniques used in the analysis of spatial (geographic) data.
3.	Teach the eprocedure to prepare, manipulate, display and analyse spatial data.
4.	Synthesise and present high quality GIS-based outputs in a report format.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand and differentiate GIS and Cartography, spatial vs. non-spatial data models.
CO2	Gain knowledge on analysis of point, line and polygone entity.
CO3	Perform network topology, connectivity analysis, shortest path and total connectivity analysis.
CO4	Understand the concept of spatial analysis of surface entity.

SYLLABUS

Topics	Lectures
UNIT-1 BASICS OF SPATIAL ANALYSIS	
Introduction and Significance of spatial analysis. Overview of tools for spatial analysis – Vector Based: Overlay Operations: Point-in Polygon, Line-in-Polygon, Polygon-in-Polygon – Single Layer Operations: Feature Identification, Extraction, Classification Manipulation – Multilayer Operation: Union, Intersection, Symmetrical Difference, Update, Merge, Append and Dissolve – Raster Based: Map Algebra, Grid Based Operations, Local, Focal, Zonal and Global Functions	**10**
UNIT-2 SPATIAL ANALYSIS OF POINT ENTITY	
Methods for evaluating point patterns: clustered and random distribution – Mapping Density and Density based analysis: Global, local density – Neighbourhood – Centrography – Distance based analysis – Gravity model – Point buffers	**16**
UNIT-3 SPATIAL ANALYSIS OF LINE ENTITY	
Network Analysis: Concepts, Accessibility – Network – Connectivity-Detour index, evaluation of network complexity using Alpha-gamma indices – C-matrices for evaluating connectivity of the network – Network data mode. Types of network analysis: Route, Closest facility, Service areas, Origin-Destination (OD) cost matrix, Vehicle routing problem, Location-allocation.	**16**
UNIT-4 SPATIAL ANALYSIS OF AREA ENTITY / SURFACE	

Zonal Statistics – Interpolations and their types. – Trend Surface Analysis (TSA) – Measures of Arrangement and Dispersion – Autocorrelation – Semi-Variogram – TIN, DEM, DTM – Contour, Slope, Aspect, Hill shade, View shed.	**14**

REFERENCES:

1. Abler, R., Adams, J. S., and Gould, P., (1971). Spatial organization: The geographer's view of the World, Englewood Cliffs, N.J., Prentice-Hall. Englewood Cliffs.
2. Burrough, P. A.., (1986). Principles of Geographical Information Systems for Land Resource Assessment. Oxford University Press Inc., New York.
3. Mitchell, a.., (1999). The ESRI Guide to GIS Analysis Volume 1: Geographical Patterns and Relationships, Environmental Systems Research Institute, Inc., Red Lands, California.
4. Mitchell, a.., Booth Bob, and Crosier Scott, (2002). ArcGIS Spatial Analyst Environmental Systems Research Institute, Inc., Red Lands, California.
5. Tsung Chang Kang, (2002). Introduction to Geographic Information Systems, Tata McGraw-Hill Publishing Company Limited, New Delhi.
6. Heywood, I., Cornellius, S., and Carver, S., (2011). An Introduction to Geographical Information Systems. Parsian Education (Singapore) Pvt. Ltd., 4th edition.

REFERENCE WEBSITES:

1. www.earthmapping.com/papers
2. www.gis.esri.com/library/userconf/proc97/to250/pap209
3. www.innovativegis.com/basis/primer/organ.html
4. http://www.csiss.org/
5. http://geog55.geog.uiuc.edu/sa

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSC-06: PYTHON PROGRAMMING

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSC	DSC 06	56		2	0	2	4

Pre-requisite(s): Programming fundamentals

Course Objectives:

This course aims to:

1.	Master the fundamentals of writing Python scripts
2.	Inspire students with the broad and real-world applications of Web GIS.
3.	Recognize situations where spatial programming is needed
4.	Integrate programming with GIS analysis

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Learn basics of Python
CO2	Develop console application in python
CO3	Develop database application in python
CO4	apply Python in geospatial analysis

SYLLABUS

Topics	Lectures
UNIT-1 INTRODUCTION, DATA TYPES AND OPERATORS	
Installation and working with Python, Variables and data types in python, Perform computations and create logical statements using Python's operators: Arithmetic, Assignment, Comparison, Logical, Membership, Identity, Bitwise operators, list, tuple and string operations	**7**
UNIT-2 PYTHON DECISION MAKING AND LOOPS	
Write conditional statements using If statement, if ...else statement, elif statement and Boolean expressions, While loop, For loop, Nested Loop, Infinite loop, Break statement, Continue statement, Pass statement, Use for and while loops along with useful built-in functions to iterate over and manipulate lists, sets, and dictionaries. Plotting data, Programs using decision making and loops.	**7**
UNIT-3 PYTHON FILE OPERATIONS & MODULES	
An introduction to file I/O, use text files, use CSV files, use binary files, Handle a single exception, handle multiple exceptions, Illustrative programs, Exercises. Importing own module as well as external modules, Programming using functions, modules and external packages Understanding Libraries, Data Frames and Basic operations with data frames.	**7**
UNIT-4 Python for GIS	
Geoprocessing with Python, Importing ArcPy, use of built-in tools, setting environments, tool messages, working with vectors and its geometries, raster data handling, batch processing, Map automations, working with toolbox. Introduction to GDAL, Geopandas, NumPy	**7**

REFERENCES:

1. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. O'Reilly Media, Inc.
2. Erik Westra (2016). Python Geospatial Development. Packt Publishing Limited; 3rd edition.
3. Eric Matthes (2019). Python Crash Course: A Hands-On, Project-Based Introduction to Programming, No Starch Press; 2nd edition.
4. Paul A. Zandbergen (2020) Python Scripting for ArcGIS Pro, ESRI Press.
5. Paul A. Zandbergen (2020) Advanced Python Scripting for ArcGIS Pro, ESRI Press.
6. Eric Pimpler (2015). Programming ArcGIS with Python Cookbook, Packt Publishing Limited; 2nd edition.
7. Laura Tateosian (2018). Python For ArcGIS. Springer, 1st edition.
8. Silas Toms, and Dara O'Beirne (2017). ArcPy and ArcGIS -: Automating ArcGIS for Desktop and ArcGIS Online with Python, Packt Publishing Limited; 2nd edition.

REFERENCE WEBSITES:

9. http://www.w3schools.com
10. http://docs.python.org
11. http://www.tutorialspoint.com
12. http://www.learnpython.org
13. https://automating-gis-processes.github.io/CSC18/
14. https://www.e-education.psu.edu/geog489/syllabus

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSE-01A: PHOTOGRAMMETRY

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSE	DSE 01A	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Introduce basic concepts of Photogrammetry and Mapping to the students
2.	Introduce the basic concepts and procedure photo measurements
3.	Understand and generate digital orthophotos from various high-resolution images
4.	Provide knowledge and skills as well as the expertise of analytical and digital photogrammetry.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand fundamentals of Photogrammetry.
CO2	Explain the concepts of Stereo image analysis includes interior orientation, exterior orientation and aerial triangulation.
CO3	Describe photographic techniques of taking reliable measurement from high resolution imageries and viewing earth objects in 3D.
CO4	Understand and work on analytical and digital photogrammetry.

SYLLABUS

Topics	Lectures
UNIT-1 AERIAL PHOTOGRAPHY	
Fundamentals of aerial photography, Basic Photogrammetry. Vertical and Oblique aerial photography, Aerial Cameras: Components, Types. Camera Calibration, Photogrammetric Applications and Products.	**10**
UNIT-2 PHOTO MEASUREMENTS	
Scale, Geometry and Ground Coverage of Aerial Photographs, Area calculation, Flight Planning. Binocular and Stereoscopic vision, Conditions for Stereo-vision, Photographic overlap, Image Parallax, Height determination from stereo pairs and single photograph-Parallax Equation, Ground Control.	**16**
UNIT-3 ANALYTICAL PHOTOGRAMMETRY	
Coordinate Systems used in Photogrammetry, Relief distortion and Tilt distortions, Rectification, Ortho Rectification, Planimetric map compilation, Concepts of orientation: Interior, Relative and Absolute Orientation of aerial photographs. Aero-triangulation, block Adjustment, Orthophotos, Types of Mosaics: Controlled, Semi-controlled, Uncontrolled.	**16**
UNIT-4 DIGITAL PHOTOGRAMMETRY	
Principles of digital photogrammetry, hardware & software requirements, Components: hardware, software, Platforms: Aircrafts, UAV, Satellites (CARTOSAT, GEOEYE, WORLDVIEW, Kompsat-3, Pléiades-HR), DEM, DSM, DTM – Contour extraction & Ortho images.	**14**

REFERENCES:

1. Karl Kraus (2007) Photogrammetry – Geometry from Images and Laser Scans, Walter de Gruyter, Berlin.
2. Wilfried Linder (2003) Digital Photogrammetry: Theory and Applications, Springer – Verlag, Berlin Heidelberg.
3. Wolf. P.R., (1974). Elements of Photogrammetry, McGraw Hill books Co., London.
4. Yves Egels, Michel Kasser (2002) Digital Photogrammetry, Taylor & Francis Group, London, UK.
5. Zhilin Li, Jun Chen, Emmanuel Baltsavias (2008) Advances in Photogrammetry, Remote Sensing and Spatial Information Sciences, CRC Press, Taylor & Francis Group, London, UK.
6. Paul R Wolf and Bon Dewitt. (2013)Elements of photogrammetry with Applications in GIS, McGraw-Hill Education; 4th edition

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSE-01B: ADVANCED SURVEYING

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSE	DSE 01B	56		2	0	2	4

Pre-requisite(s): None

Course Objectives:

This course aims to:

1.	To study about the modern survey equipments and their use in precision surveying
2.	Inspire students with the broad and real-world applications of surveying
3.	Teach the procedure to collect, prepare, display and analyze surveyed data
4.	The ability to apply different data acquisition methods such as Total Station survey, GPS etc. for field problems

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand the principles of various modern survey method
CO2	Identify the principles of electronic surveying
CO3	Map the features with GPS
CO4	To understand the UAV principles and functions

SYLLABUS

Topics	Lectures
UNIT-1 PRINCIPLES OF SURVEYING	
Basic principles, classifications, applications, conventional surveying and Electronic Surveying, principle of working and EDM instruments, application of Lasers in distance measurement	**10**
UNIT-2 INTRODUCTION TO TOTAL STATION	
Principle and Function. Process of data collection and analysis. Use of Total Station in Topographical Survey, Application of Total Station in Various Fields.	**16**
UNIT-3 INTRODUCTION TO GPS	
Introduction to GPS, and dGPS: Principle and Functions, Use of dGPS in Topographical Survey, Application of dGPS Points in DEM Generation from Stereo Images	**16**
UNIT-4 INTRODUCTION TO UAV	
UAV: Principle and Functions, Drone selection process, Flight preparations, Flight planning and data processing software, Ground control points, current rules and regulations governing owning and operating a UAV in the India.	**14**

REFERENCES:

1. Hoffman. B, H. Lichtenegga and J. Collins, "Global Positioning System – Theory and Practice", Springer – Verlag Publishers, 2001
2. Satheesh, G., Sathikumar, R. and Madhu, N. (2007): Advanced Surveying: Total Station, GIS and

Remote Sensing, Pearson Education, Delhi

3. Mohinder, S. G., Lawrence, R. W. and Angus, P. A. (2001): Global Positioning Systems, Inertial Navigation and Integration, John Wiley and Sons Inc., New York.
4. Lawrence, L. and Alex, L. (2008): GPS Made Easy: Using Global Positioning Systems in the Outdoors, Rocky Mountain Books, Calgary
5. Barnhart, R., Michael, M., Marshall, D., and Shappee, E. ed. 2016. Introduction to Unmanned Aircraft Systems, 2nd edition. Boca Raton. CRC Press. ISBN ISBN 978-1482263930.
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2. https://wingtra.com/learn/
3. https://www.pix4d.com/industry/surveying-mapping
4. https://www.dronezon.com/learn-about-drones-quadcopters/introduction-to-uav-photogrammetry-and-lidar-mapping-basics/

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DILIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websited e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

APPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSE-02A: SPATIAL DATABASE MANAGEMENT

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSE	DSE 02A	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Describe the purpose of a data model in terms of spatial data management system.
2.	Compare and contrast logical data models as related to spatial database management systems implementations.
3.	Understand and create the concept of database management system and its application in GIS.
4.	Prepare an overview of Esri enterprise spatial database management approaches for data management environments.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand basic concepts in database management systems.
CO2	Design well formed database models, using appropriate design techniques, and be able to implement such designs using relational database software
CO3	Use SQL to establish and interrogate database
CO4	Create and manage a Geodatabase for effective spatial analysis and querying.

SYLLABUS

Topics	Lectures
UNIT-1 INTRODUCTION	
An overview of database management system, , Database system Vs file system, Database system concept and architecture, Data Definitions Language, Introduction to DBMS – types of DBMS – data models – ER model– Notation for ER diagram.	**10**
UNIT-2 MANAGING SCHEMA OBJECTS	
Managing Schema Object: Data Types, DDL, DML, DCL Constraints: Types of Constraints, Primary Key, Foreign Key, Check Constraint, Not Null, Altering Constraint, Concept of Backup Recovery. Overview of Index.	**16**
UNIT-3 SQL STATEMENTS	
Manipulating Dataset using SQL Statement: Basic Select Statement, Selecting Specific Column, Using Arithmetic Expressions, Defining Column Alias, using Where Clause, Restricting & Sorting Data: using Comparison Condition, Logical Operator, BETWEEN, LIKE Conditions. SQL Function: Displaying Data From Multiple Tables, Concept of Function, Group Functions, Types of Joins, Concept of Sub-Query, Types of Sub Queries.	**16**
UNIT-4 GEODATABASE	

Geodatabase: Advantages, Types, Components, Working with feature datasets, Geodatabase schema. mosaic datasets. – Attribute Domains – Geodatabase Topology – defining the relationship class – geometric networks – Geocoding services – Building geodatabases with CASE tools	**14**

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1. Codd, E. F. (1970). A relational data model for large shared data banks. Communications of the ACM 13(6), 377-387.
2. Rigaux, P., M. Scholl and A. Voisard (2002). Spatial Databases: With Application to GIS. San Francisco:Morgan-Kaufmann.
3. Shekhar, S. and S. Chawla (2003). Spatial Databases: A Tour. New York: Pearson Higher Education.
4. West, M. (2011). Developing High Quality Data Models. San Francisco, CA: Morgan Kaufmann Publishers Inc.
5. Yeung, A. and B. Hall (2007). Spatial Database Systems: Design, Implementation and Project Management, Springer, Dordrecht, Netherlands.

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1. https://open.ems.psu.edu/node/1357
2. https://gisgeography.com/spatial-databases/
3. https://desktop.arcgis.com/en/arcmap/10.3/manage-data/geodatabases/what-is-a-geodatabase.htm

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSE-02B: SPATIAL STATISTICS

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSE	DSE 02B	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Introduce the findamentals of spatial statistics.
2.	study and understand the concept of geostatistics and its applications in Geoinformatics.
3.	study the methodology and designs, geosaptial relations and spatial process and modelling.
4.	Introduce various type of Spatial Processing and Modelling.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand concepts and calculation of spatail stastistics.
CO2	solve various problems in the field of geostatistics.
CO3	Use various statistical mthods to sole spatial problems
CO4	Use and work on spatial statistics for studying spatial relations, processes and modelling.

SYLLABUS

Topics	Lectures
UNIT-1 METHODOLOGY AND DESIGNS	
Problem identification-objectives-variables and attributes-management of univariate and multivariate data - concepts and application of Normal-Gamma and Gaussian distributions - population-sample-sampling-spatial sampling practice - Statistical testing t, f, X2 and Z applications.	**10**
UNIT-2 BASIC OF DATA EXPLORATION	
Raw data relative data tables - dot plots in univariate – bivariate explorations - Diagram as tools of exploration: histogram – bar chart – paretochart – line graphs-box plots – stem or leaf plots - q-q plots p-p plots – ogives – class interval selection in thematic mapping.	**16**
UNIT-3 GEOSPATIAL RELATIONS	
Concepts of interdependence – dependences – independence, correlations: simple – multiple correlation – autocorrelation – cross correlation – variograms – kriging –partial correlations – univariate – multivariate.	**16**
UNIT-4 SPATIAL PROCESSES AND MODELING	
Pattern recognition in point – line – area distribution – network analysis – space partitioning – multivariate classification methods: factor analysis methods – classification methods – overlay analysis.	**14**

REFERENCES:

1. Aslam Mahmood, and Moonis Raza, (1986). Statistical Methods in Geographical Studies, Rajesh Publications, New Delhi.
2. Davis, (1986). Statistics and Data Analysis in Geology, John Willy & Sons Inc., New York.
3. ArcGIS Geostatistical Analyst: ArcGIS 9 by ESRI Press Publisher, Red Lands, California.
4. FitzGerald B. F., (1974). Development in Geographical Method, Science in Geography – 1, Oxford University Press, Oxford.
5. Doaugherty Richard, (1974). Data Collection, Science in Geography – 2, Oxford University Press, Oxford.
6. Davis Peter, (1974). Data Description and Presentation, Science in Geography - 3, Oxford University Press, Oxford.
7. McCullagh Patrick, (1974). Data Use and Interpretation, Science in Geography – 4, Oxford University Press, Oxford.
8. Anil Kumar Mehrotra (2020). Geostatistics For Beginners, Zorba Books; 1st edition

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9. https://osf.io/6jzpn/download
10. https://www.qgis.org/en/site/

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

SEC-02: OPEN SOURCE GIS

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
SEC	SEC 02	28		2	0	0	2

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Introduce the findamentals of Open Source softwares and services.
2.	Gives complete freedom to modify the software to suit the needs.
3.	Exposes stdents to major avenues of open source opportunities.
4.	Introduce various type of Open Source Image processing, GIS and Geo-Statistical softwares.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand concepts and protocols used in Open Source GIS.
CO2	Acquire knowledge on functionalities of Open Source GIS software in Desktop and Web based environments.
CO3	Use various available Open Source GIS software and their architecture.
CO4	Use and work on Open Source GIS and Remote softwares, Servers and Services.

SYLLABUS

Topics	Lectures
UNIT-1 FUNDAMENTALS	
Concepts of free and proprietary software – Free, Shareware and Open Source Software - Levels of open source licensing - Role of open source software in Remote Sensing and GIS Implementation - OGC, OSGeo and GDAL oraganisations - Open Source Standards - FOSS and FOSS4G	**7**
UNIT-2 DESKTOP GIS WITH OPEN SOURCE GIS	
Introduction to QGIS, Interface of the software, Plugins - Installing and Managing Plugins, Useful QGIS Plugins. Working with Vector and Raster data.	**7**
UNIT-3 GEOSPATIAL SERVER, WEB SERVICES	
Online Resources - Introduction to Open Data Kit (ODK), Web Mapping Services: WMS, WCS, WFS and WPS - Web GIS Services and GeoWeb - Image and map rendering.	**7**
UNIT-4 OPEN SOURCE SOFTWARE AND SERVICES	
OS Remote Sensing software (Eg: ILWIS, OSSIM, ORFEO, OpenEV) - Desktop systems (Grass, gvSIG, QGIS and SAGA) - GeoServer and Map Server - Embedded scripts for GIS services (HTML with PHP and Python) - Geo Statistical operations and Open Statistical tools - R environment and R spatial - standards in GIS documents.	**7**

REFERENCES:

1. Mitchell T „Web mapping illustrated", O"Reilly Media Inc., Sebastopol, Canada, 2005

2. Neteler M, Helena M „Open source GIS: A GRASS GIS approach", 3
3. rd edition, Springer, New York, 2008
4. Bill Kropla Beginning Map Server: Open Source GIS Development, Apress (Springer Verlog) New York, 2005.
5. Peng, Z.R. and Tsou, M.H. Internet GIS: distributed geographic information services for the Internet and wireless networks. New York: John Wiley and Sons, New York, 2003.

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3. https://r.esri.com/
4. https://grass.osgeo.org/
5. http://www.saga-gis.org/en/index.html
6. http://geoserver.org/
7. https://openlayers.org/
8. https://mapserver.org/
9. http://postgis.net/
10. https://www.osgeo.org/
11. https://www.ogc.org/standards/

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

PRACTICAL-03: PRACTICAL IN DIGITAL IMAGE PROCESSING

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
Practical	PRACT 03	56		0	0	4	2

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Introduce the various satellite image processing softwares and tools
2.	Providing basic concepts of image processing and extensive hands-on-experience of working on ERDAS IMAGINE software
3.	Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand the steps involved in image processing task.
CO2	Understand the relevant aspects of digital image representation and their practical Implications
CO3	Understand and carryout image correction, enhancement and classification.
CO4	Conduct independent study and analysis of image processing problems and techniques

SYLLABUS

Lab No	Topics	Lectures
1	REMOTE SENSING IMAGE DISPLAY AND INITIAL STATISTICAL EXTRACTION: Introduction to ERDAS IMAGINE, Image Display Procedures, Imagine Viewer Functions, Global Image Information, Layer Info, Spectral and Spatial Profile.	**4**
2	IMAGE DATA PREPARATION: Stacking images, Display different false color composites, Layer Subset.	**4**
3	RADIOMETRIC AND ATMOSPHERIC CORRECTION: Convert DN Values to Radiance and Reflectance, Empirical Line Calibration, Radiometric Correction (ELC), Haze Reduction.	**6**
4	GEOMETRIC CORRECTION: Image-to-map rectification; Image-to-image registration; Rectification using GNSS derived GCP	**6**
5	ENHANCEMENT OF MULTISPECTRAL IMAGES: LookUp Table and File Pixel, Radiometry Adjustments, Histograms, Contrast Stretching and Histogram Equalization, Standard Deviation Stretch, Level Slice.	**4**
6	SPATIAL FEATURE MANIPULATION: Spatial Filtering: Sharpen (high pass filter), Smooth (low pass filter). Fourier Transformation.	**4**
7	MULTI-IMAGE MANIPULATION: Band Ratioing, Image Indices, Principal Components Analysis (PCA).	**4**

8	RESOLUTION MERGE: Resolution Merge using Principal Components, Wavelet Resolution Merge,	**4**
9	Unsupervised Image Classification	**5**
10	Supervised Image Classification	**5**
11	Object Based Image Analysis: Introduction to Ecognition	**6**
12	Accuracy Assessment	**4**

REFERENCES:

1. Lillisand T.M, R.W. Kiefer & Chipman (2015) Remote Sensing and Image Interpretation (7th edition). John Wiley & Sons, New York.
2. Jensen, J. R. (2016): Introductory Digital Image Processing: A Remote Sensing Perspective (4th Edition), Pearson Publication.
3. R.C.Gonzalas and R.E.Woods (2016): Digital Image Processing, Prentice Hall, 3rd Ed., Pearson India.
4. A.K.Jain (2015): Fundamentals of Digital Image Processing (1st Edition), Pearson Education India.
5. Prithvish Nag, and Kudrat, M., (1998). Digital Remote Sensing, Concept Publishing Company, New Delhi.
6. Paul Gibson, and Clare H. Power, (2000). Introductory Remote Sensing: Digital Image Processing and Applications, Routledge Publisher, London.
7. Richards, J. A., Jia, X. (2000): Remote Sensing and Digital Image Processing, Springer, Verlag Berlin.

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2. https://www.hexagongeospatial.com/resources/resource-library/webcasts

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Field Visit, Experimental Learning
CD4	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

PRACTICAL-04: PRACTICAL IN GEOSPATIAL ANALYSIS

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
Practical	PRACT 04	56		0	0	4	2

Pre-requisite(s): DSC-5, DSC-6

Course Objectives:

This course aims to:

1.	Introduce the basic concepts of spatial analysis and familiarize with geoprocessing tools.
2.	Understand the working principles of the geoprocessing tools and techniques.
3.	Facilitate students wishing to produce publication quality maps and figures
4.	Facilitate classroom instruction for the analysis of geospatial data

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Prepare, manipulate, display and analyse spatial data.
CO2	carryout spatial analysis to solve the real world spatial problems.
CO3	synthesise and present high quality GIS-based outputs in a report format.
CO4	Create and manage a Geodatabase for effective spatial analysis and querying.

SYLLABUS

Lab No	Topics	Lectures
1	Querying Data: Selecting and finding features – Selecting features by location and attribute – Combining attribute and location queries.	**6**
2	Geoprocessing Vector Data: Buffering features – Vector (Feature) Overlay: Identity, Intersect, Symmetrical difference, Union, and Update.	**6**
3	Geoprocessing Raster Data: Masking layer – Raster Overlay: Zonal Statistics, Combine, Weighted Overlay, Weighted Sum.	**6**
4	Feature-based proximity analysis-Buffer and Multiple Ring Buffer, Near, Thiessen Polygons.	**6**
5	Raster-based distance analysis: Euclidean distance, Euclidean allocation, Euclidean direction, Cost distance, Cost Allocation, Path distance.	**6**
6	Spatial Statistical analysis: Geographic distribution measurements, Geographic pattern analysis, Geographic cluster analysis, Regression analysis, Raster statistics.	**6**
7	Density Analysis: Kernel Density, Line Density, Point Density	**4**
8	Interpolation Techniques: IDW, Kriging, Natural Neighbor, Spline, Spline with Barriers, Trend.	**4**
9	Network Analysis: Network Analysis Layers, Locating Analysis Input, Analysis Options.	**6**
10	Surface Analysis: Handling TIN, DEM, DTM dataset. Slope, Aspect, Hillshade, Curvatur, Contour, Contour List, Viewshed, Visibility, Observer Points.	**6**

REFERENCES:

1. Abler, R., Adams, J. S., and Gould, P., (1971). Spatial organization: The geographer's view of the World, Englewood Cliffs, N.J., Prentice-Hall. Englewood Cliffs.
2. Burrough, P. A.., (1986). Principles of Geographical Information Systems for Land Resource Assessment. Oxford University Press Inc., New York.
3. Mitchell, a.., (1999). The ESRI Guide to GIS Analysis Volume 1: Geographical Patterns and Relationships, Environmental Systems Research Institute, Inc., Red Lands, California.
4. Mitchell, a.., Booth Bob, and Crosier Scott, (2002). ArcGIS Spatial Analyst Environmental Systems Research Institute, Inc., Red Lands, California.
5. Tsung Chang Kang, (2002). Introduction to Geographic Information Systems, Tata McGraw-Hill Publishing Company Limited, New Delhi.

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3. www.innovativegis.com/basis/primer/organ.html
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5. http://www.spacestat.com/
6. http://www.terraseer.com/
7. http://geog55.geog.uiuc.edu/sa

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Field Visit, Experimental Learning
CD4	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

Semester Three

SEMESTER - III

DSC-07: ADVANCED REMOTE SENSING

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSC	DSC 07	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	To acquire knowledge in basic concepts of Hyperspectral & Microwave Remte Sensing
2.	Understand the basic concepts and working procedure LiDAR and GPR
3.	Understand and interprete the Thermal Remote Sensing data. and its product.
4.	Provide expected knowledge and skills of UAV Surveying and Mapping.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand the concept and working principles of Hyperspectral & Microwave Remte Sensing.
CO2	acquire knowledge on Principles, components and survey methods of Ground Penetrating Radar (GPR).
CO3	Understand and interprete the Thermal Remtoe Sensing data.
CO4	gain knowledge on UAV Mapping and its application.

SYLLABUS

Topics	Lectures
UNIT-1 HYPERSPECTRAL AND MICROWAVE REMOTE SENSING	
Hyperspectral Remote Sensing: Concept, Multispectral Vs. Hyperspectral, Spectral Radiometry – spectral library, Hyperspectral Satellites. Microwave Remote Sensing: Concept, Sensors, Radar Operating Principles, Synthetic Aperture Radar, Radar Image Characteristics, SAR Interferometry, and its applications	**10**
UNIT-2 LiDAR and GPR	
Concepts, LiDAR sensor system, LIDAR File Formats, Accuracy of LiDAR measurements, Ground Penetrating Radar (GPR): Principles – components of GPR - electrical and magnetic properties of rocks – soil – fluids – survey methods; 2D survey – 3D survey and GPR application	**16**
UNIT-3 THERMAL REMOTE SENSING	
Thermal Remote Sensing: Plank's blackbody law – displacement law and emissivity effects - heat capacity, thermal conductivity - thermal inertia – diurnal heat effects – thermal property of objects – thermal sensors – thermography – thermal image interpretation.	**16**
UNIT-4 UAV MAPPING	
UAV Mapping – Types – Components – Data Processing – Regulations for UAV in India and World, Payloads and Sensor Integration, Navigation Planning – Applications.	**14**

REFERENCES:

1. Ulaby,F.T., Moore,K.R. and Fung (1986) Microwave remote sensing, Addison-Wesley Publishing Company, London,
2. Lillisand. T.M, and Kiefer, P.W., (1998). Remote Sensing and Image Interpretation, John Wiley & Sons, New York.
3. Harry M. Jol (2009) Ground Penetrating Radar Theory and Applications, Elsevier Science, Amsterdam.
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COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSC-08: ADVANCED GIS AND MODELLING

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSC	DSC 08	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Provide the GIS modellin processes
2.	enable students to understand and use various patial decision making models.
3.	Provide students the concept and use of Spatial Data Mining.
4.	Familiarise the recent trends and techniques in Geospatial Technology.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand the GIS modelling process
CO2	Acquire knowledge on Spatal Decision making using various MCDA
CO3	Use spatial data mining process for database preparation
CO4	Acquainted with modern tools and techniques used in Geospatial Technology.

SYLLABUS

Topics	Lectures
UNIT-1 GIS MODELLING	
The GIS modeling process: Define the goal and criteria of the analysis, Collect the data, Run the model, Verify the results, Modify and rerun the model, Document the analysis, Display and apply the results. Modeling and GIS Data.	**10**
UNIT-2 SPATIAL DECISION	
Multi-Criteria Decision Analysis, Designing a Boolean suitability model, Finding suitable locations using overlay, Rating Suitable Locations: Designing a suitability model, Designing a suitability model, Rating locations using fuzzy overlay.	**16**
UNIT-3 SPATIAL DATA MINING	
Concept, Data Mining Techniques, Methods of Clustering, Exploring, Spatial Association, Mining in Raster Database	**16**
UNIT-4 RECENT TRENDS IN GIS	
History of Network Technology, Interoperability Specifications, Location-based services, Cloud-GIS, CyberGIS, Crowd Sourcing, Big Data Analytics, Machine learning, Support vector machine, Geospatial Artificial Intelligence, Open Source Software and Open Data.	**14**

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1. Andy Mitchell (2012). The Esri Guide to GIS Analysis, Volume 3: Modeling Suitability, Movement, and Interaction (The ESRI Guide to GIS Analysis, 3), Esri Press; 1st edition.
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5. https://www.gislounge.com/cloud-gis-terms/

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSC-09 : GEOINFORMATICS FOR NATURAL RESOURCE MANAGEMENT

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSC	DSC 09	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Provide exposure to students in gaining knowledge on concepts and applications
2.	Lead students to modelling of earth resources management using Geospatial technologies.
3.	Understand and create the concept of database management system and its application in GIS.
4.	Provide expected knowledge and skills as well as the expertise for spatial data analysis.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Gain knowledge on Concepts, classification and appraisal of Natural resources
CO2	Know about natural resources management and Sustainability
CO3	To know about methods of Land evaluation, land classification soil erosiion, bioresource assessment, water conservation and disaster management.
CO4	Gain knowledge on Natural resource surveys and monitoring and case studies of Natural Resources Management with Geoinformatics applications.

SYLLABUS

Topics	Lectures
UNIT-1 LAND RESOURCE	
Concept of Resources: Concepts, classification, Natural Resource Management and Sustainable development. Land Use and Land Cover mapping- land utilization. Land Resource: Soil Erosion, Land Degradation	**10**
UNIT-2 BIO-RESOURCE	
Remote Sensing Application in Agriculture, Forest Resource, Vegetation Classification and Mapping, Forest Fire Modelling and Risk Zonation, Wildlife Habitat Assessment Modelling,	**16**
UNIT-3 WATER RESOURCE	
Remote Sensing Application in Surface and Sub-surface Water Resources, Water Pollution, Water Quality, Issues in Water Resources Managements. Ocean Resources Management	**16**
UNIT-4 DISASTER MANAGEMENT	
Disaster Management: Natural and Man-Made Disasters. Types, Zoning and Preparedness, Drought and Flood mapping using indices, Desertification, Landslide Hazard Zonation.	**14**

REFERENCES:

1. Holechek, J. L., R. A. Cole, J. T. Fisher, and R. Valdez (2003) Natural Resources: Ecology, Economics and Policy (2nd Edition). Prentice Hall Education.
2. Knight, Richard L., and Sarah F. Bates (1995). A New Century for Natural Resource Management.

Island Press Publishing.
3. Lilesand and Keifer (2000): Introduction to remote sensing and Image Interpretation; John Willy & sons Ltd., New York.
4. Colin W.Mitchell (1991) Land Evaluation, Longman scientific& Technical, co published with John Wiley & sons Inc, New York.
5. Burrough, P.A. (1986). Principles of Geographical Information Systems for Land Resource Assessment, Clarendon Press, Oxford, New York.

REFERENCE WEBSITES:

1. https://www.esri.com/en-us/industries/natural-resources/overview
2. https://www.gislounge.com/gis-and-natural-resource-management/
3. http://www.ijiras.com/2015/Vol_2-Issue_4/paper_11.pdf

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSE-03A: GEOINFORMATICS FOR HYDROLOGY

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSE	DSE 03A	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Deals with the basics of hydrology and also various remote sensing and GIS applications in the field of hydrology and water resources.
2.	Understand the assessment of Basin and its hydrology using Geospatial technology.
3.	Get exposure to the Groundwater and Watershed Management aspects of GIS.
4.	Provide expected knowledge and skills to run water resources models.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Get knowledge on hydrology, scientific hydrology development, hydrological cycle etc.
CO2	Familiar about application of GIS in water quality monitoring, water resource planning and management and Hydrologic Information System
CO3	Learn about Approaches to planning and development of water resources and methods to evaluate surface water resources and groundwater, policies and management.
CO4	Use of GIS for surface water modelling, groundwater modelling, and flood plain mapping.

SYLLABUS

Topics	Lectures
UNIT-1 WATERSHED MANAGEMENT	
Hydrologic Cycle, Hydrological parameters, porosity, permeability, specific yield, types of aquifers. Watershed Management, Watershed characterization:Drainage Morphometry: areal, linear, relief, hydrograph analysis, delineation and codification, watershed problems and management strategy. Geoinformatics approach for watershed prioritization.	**10**
UNIT-2 SUB-SURFACE WATER	
Subsurface Water Exploration: Application of remote sensing in hydro- geomorphological interpretation for ground water exploration, water quality monitoring through remote sensing.	**16**
UNIT-3 OPERATIONAL APPLICATIONS	
Flood prediction, drought evaluation, snow cover mapping and reservoir sedimentation evaluation.	**16**
UNIT-4 MODELS IN WATER RESOURCES	
Geoinformatics based Runoff and hydrological modelling, flood Hazards modelling, snowmelt runoff modelling. Case Studies: Hydro-geomorphological mapping in Plateau region, Flood Prone zone mapping in Indo- Gangetic Plains, Water harvesting Initiatives in Urban built up area.	**14**

REFERENCES:

1. Todd, D.K (1989) Groundwater Hydrology, John Wiley Sons, New Delhi
2. Lyon, J.G (2003) GIS for Water Resources and Watershed Management. Taylor and Francis, New York.
3. Sharad K. Jain, V.P Singh (2003) Water Resources Systems Planning and Management, Elsevier B.V, Netherlands.
4. David R Maidment(2002) Arc Hydro:GIS for Water Resources, Volume I,ESRI Press, Redlands, USA.
5. Lynn E Johnson (2009) Geographic Information systems in water resources engineering, Taylor and Francis Group, New York.
6. Chow, David R Maidment, Larry W.Mays (2010) Applied Hydrology, McGraw Hill Book Company, New Delhi.

REFERENCE WEBSITES:

1. http://resources.arcgis.com/en/communities/hydro/
2. https://www.aquaveo.com/software/wms-learning-tutorials
3. http://www.ce.utexas.edu/prof/maidment/visual/dallas/jay/sld001.htm

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSE-03B: WEB GIS

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSE	DSE 03B	56		4	0	0	4

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Provide students with basic concepts, principles, related fields of Web GIS.
2.	Inspire students with the broad and real-world applications of Web GIS.
3.	Provide students with the state-of-art technical skills and the knowledge for Web GIS Application.
4.	Provide expected knowledge and skills to create Open Web Mapping using Open Source Servers.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Understand the Web GIS, including the basic concepts, principles, related fields.
CO2	Acquire knowledge on Principles, and function of Web GIS and Internet GIS
CO3	Create Open Web Mapping using Open Source Servers.
CO4	Use and work on ArcGIS Server, ArcSDE, Utility GIS softwares, ArcGIS Pro, ArcGIS Online.

SYLLABUS

Topics	Lectures
UNIT-1 CONCEPTS OF WEB-GIS	
Web GIS: Definition – concept of Web GIS, History of Web GIS, components of web GIS, web GIS v/s Internet GIS, Distributed GIS – Advantages and Limitations of web GIS – Web Page Basics – Web mapping: static and interactive web mapping,	**10**
UNIT-2 OPEN WEB MAPPING	
Web Map services – Web Server, MapServer and GeoServer – Open GIS web map server – Commercial web mapping programs – OGC framework of open web mapping – importance of open web mapping – International open web standards as published by the Open Geospatial Consortium – Web based databases: OpenStreet Map, Overpass turbo, Kepler.gl, Mapbox, Post GIS	**16**
UNIT-3 ArcGIS SERVER & ArcSDE	
ArcGIS Server ArcSDE: ArcGIS Server and Architecture – Web Application Functionality, GIS Web Service. ArcSDE: Introduction – SDE Connection – Configuration Options – SDE for Developers Data Storage: SDE Geodatabase – ArcSDE Architecture.	**16**
UNIT-4 UTILITY GIS & MOBIL GIS	
Utility GIS: Ericsson Network Engineer Software – Arc FM – R-APDRP – Enterprise GIS – ArcGIS online – ArcGIS pro – Introduction to Google Earth Engine. Mobile GIS: system and generic architecture of Mobile GIS – Operating systems for Mobile GIS – Wireless web – Samples of programs used in Mobile GIS – Real-time applications – Customization of Mobile GIS.	**14**

EFERENCES:

1. Cartwright, W., Peterson, M. P., and Gartner G. (Eds) (2007), Multimedia Cartography, Springer, Berlin.
2. Kraak, M. J., and Brown, A., (2001). Web Cartography: Development and Prospects, Taylor and Francies, London.
3. Kraak, M., and Ormeling, F., (2003). Cartography: Visualization of Geospatial Data, Pearson Education, New Delhi.
4. Kropla B., (2005). Beginning MapServer Open-Source GIS Development, Apress, New York.
5. Pinde Fu and Jiulin Sun, (2010). Web GIS: Principles and applications, ESRI Inc.,U.S.
6. Pinde Fu (2020). Getting to Know Web GIS, ESRI Inc.,U.S.
7. Tyler Mitchell (2015). Web Mapping Illustrated: Using Open Source GIS Toolkits, O'Reilly; 1st edition.

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1. http://mapserver.gis.umn.edu
2. http://postgis.org/home
3. http://www.bostongis.com
4. http://132.72.155.230:3838/js/index.html
5. https://www.e-education.psu.edu/spatialdb/l5_p3.html
6. https://earthengine.google.com/
7. https://kepler.gl/
8. https://myarcfm.schneider-electric.com/myarcfm/s/

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

DSE-03C: GIS FOR PUBLIC HEALTH

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
DSE	DSE 03C	56		4	0	0	4

Pre-requisite(s): DSC-3, DSC-4

Course Objectives:

This course aims to:

1.	Enable students to critically evaluate recent developments in health from a spatial perspective.
2.	Introduce the use of GIS-based analyses of health data.
3.	Teach to use GIS tools to identify spatial patterns in health and to undertake an exploratory analysis of potential explanatory factors.
4.	Explain the influencing patterns of health and the role that GIS can play in exploring it.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Apply principles of geospatial information science to health research and practice.
CO2	Use GIS techniques for accessing the information for building useful geodatabases.
CO3	Employ GIS tools that support health research & decision making in public health practice.
CO4	Implement and manage Health GIS projects in government & community settings.

SYLLABUS

Topics	Lectures
UNIT-1 INTRODUCTION TO HEALTH GIS	
Definition of Health GIS, Definition of epidemiology. Uses of epidemiology. Epidemiological triad. Chain of infection. Modes of transmission of infection. Epidemiology of communicable and non-communicable diseases. Public health infrastructure system: Understanding of the network of health facilities in India. Primary Health Centre infrastructure, Sub-Centre Infrastructure, Health staff in Periphery. Uses and application of Health GIS technology in disease management. Examples of application of GIS in Health and Disease. Case study by John Snow of cholera epidemic.	**10**
UNIT-2 TYPES OF DATA FOR HEALTH GIS	
Different types of Data used in health GIS. Sources of Health and Disease data for GIS analysis. Health Information System. Integrated disease surveillance project (IDSP). Data available in Public Domain. Methods of collecting health and disease data. Privacy and Confidentiality concerns of Mapping health and disease data. Limitations associated with spatial data (MAUP, Boundary effects, Patterns).	**16**
UNIT-3 SPATIAL ANALYSIS OF HEALTH DATA	
Summary statistics, Spatial data distributions. Calculation of risk used to characterize Overall health of Populations (Rate, Ratio, Proportions, Incidence rate, prevalence rate, mortality rates). Basic GIS operations and Five Spatial Analysis for visualizations of health data. Point pattern analysis for vector borne disease data with examples.	**16**

Spatial Interpolation with examples. Hot Spot analysis for Disease Data with examples. Analyzing Spatial Clustering of Health Events: Mapping Disease Rates: Spatial Clustering Methods, Space–Time Clustering, Choosing a Clustering Method, and its uses. GIS and Environmental Risk Management, Gis for Modeling of Vector-Borne Diseases	
UNIT-4 ANALYZING ACCESS TO HEALTH SERVICES USING GIS	
Factors determining accessibility to health care. Modeling and Approaches to accessibility to health care based on distance, time, and cost. Solutions to improve access to health care. Mapping Service Locations, Mapping Health Care Needs and Services, Assessing Potential Access to Health Services, Analyzing Service Utilization. Locating Health Services: Health Care Shortage Areas, Components and Dimensions of Health Service Delivery Systems, Client Population Distribution, The Meaning of "Centrality" in Health Service Facility Location, Normative Models of Facility Location and Service Delivery using GIS, Health Services Delivery in Response to Disasters. Assessing Health Disparities using GIS.	**14**

REFERENCES:

1. Bonita, R., Beaglehole, R., Kjellstrom, T. (2006) Basic epidemiology, 2nd Ed. World Health Organization (WHO), Geneva, Switzerland.
2. Park's Text Book Of Preventive And Social Medicine : 26th Edition-(2021)
3. Ellen K. Cromley and Sara L. McLafferty (2011). GIS and Public Health, Guilford Press; 2nd edition.
4. Kristen S. and Wilpen L. Gorr (2014). GIS Tutorial for Health, ESRI Inc.,U.S.; 5th edition.
5. Dirk U. Pfeiffer et. al. (2008). Spatial Analysis in Epidemiology, OUP Oxford; 1st edition.
6. Markku Loytonen et. al. (2007). GIS And Health (GISDATA Book 6), 1st edition.
7. Mark Stevenson et. al. (2007). Spatial Analysis in Epidemiology, Oxford University Press.
8. Laura Lang (2000). GIS for Health Organizations, ESRI Inc., U.S.

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

SEC-03: GIS PROJECT MANAGEMENT

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
SEC	SEC 03	28		2	0	0	2

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Introduce the project management techniques and decision tools.
2.	Explain concepts, principles, processes and practice of project management.
3.	tntroduce relationships among project, program, portfolio, and operational management
4.	Teach the ways to effectively integrate a project across enterprise to reduce the impact of change.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Apply and critically evaluate the project management techniques and decision tools.
CO2	Solve simple network diagrams problems and perform basic scheduling calculations
CO3	Recognize the relationships among project, program, portfolio, and operational management
CO4	Determine ways to effectively integrate a project to reduce the impact of change..

SYLLABUS

Topics	Lectures
UNIT-1 INTRODUCTION	
What is Project, Project Attributes, Project Management Knowledge Area, Project Management Tools and Techniques, Project Success Factors, Framework. Identification of Problem of Regional and Local Level–Geographical Data Source and Nature of Data to Be Used–Preparation of Field Report–Spatial Data-Classification and Sampling Problem-Phases of a Project Life Cycle-Project initiation-Project Planning–Project Execution-Project Monitoring and Controlling.	**7**
UNIT-2 GIS PROJECTS-INTEGRATION	
Scope and Time management-Scope Management–Scope Planning-Scope Management Plan-Scope Definition–Creating the Work Breakdown Structure–Approaches to Develop Work Breakdown Structure–Time Management–Network Diagram–Activity Resource Estimation–Activity Duration Estimation–Cost Management–Project Quality Management	**7**
UNIT-3 PERT AND CPM	
PERT and CPM: Introduction-Development of Project Network-Time Estimation-Determination of the Critical Path-PERT Model-Measures of Variability-CPM Model-Responsibility and Team Work.	**7**
UNIT-4 PROJECT RISK MANAGEMENT	
Understanding Risk Management–Common Sources of Risk on GIS Projects–Risk Identification and Analysis – Qualitative Risk Analysis –Strategies to Respond to Risk –Risk Monitoring and Control.	**7**

REFERENCES:

1. Business driven information systems / Paige Baltzan, Daniels College of Business, University of Denver, New York, NY : McGraw Hill Education, [2016]
2. Enterprise analytics: optimize performance, process, and decisions through big data / [edited by] Thomas H. Davenport, Upper Saddle River, N.J.: FT Press, 2013.
3. Information systems project management By David L. Olson, New York : Business Expert Press, 2015
4. Roger Tomlinson (2011). Thinking About GIS: Geographic Information System Planning for Managers, ESRI Press; 4th edition.

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2. https://www.researchgate.net/.../273569026_Comparison_of_open_source_tools
3. https://www.softwaretestinghelp.com/requirements-management-tools/
4. https://project-management-software.financesonline.com/c/task-management
5. https://www.projectmanager.com/category/templates

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Self- learning such as use of NPTEL materials and websites e.g. NRSC, NAASA, USGS
CD4	Field Visit, Experimental Learning
CD5	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

PRACTICAL-05: ADVANCED GEOSPATIAL ANALYSIS

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
Practical	PRACT 05	56		0	0	4	2

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Introduce the GIS techniques to solve the real world spatial problems
2.	Understand the problems and procedure to construct a methodology to solve the problem.
3.	Facilitate students to learn advanced Geospatial Analysis and techniques.
4.	Facilitate classroom instruction for the analysis of geospatial data

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Carry out spatial data analysis to solve natural, environmental and societal problems and challenges.
CO2	Elucidate integrated geospatial techniques and apply them in solving real world problems.
CO3	Understand and Create GIS data models
CO4	Create and manage a Geodatabase for effective spatial analysis and querying.

SYLLABUS

Lab No	Topics	Lectures
1	Land Use Land Cover Change Detection and Analysis	**4**
2	Delineation of watershed and Drainage using Model Builder	**4**
3	Watershed Prioritisation based on morphometric Analysis	**4**
4	Mapping of Hydrogeomorphology and Ground water prospects.	**4**
5	Estimation of USLE parameters for soil erosion modelling	**4**
6	Mapping flood hazard zones using RS & GIS	**4**
7	Landslide Hazard Zonation Mapping	**6**
8	Land Suitaility Mapping	**6**
9	Forest Fire Modelling and Risk Zonation	**4**
10	Cliamte Change study using Multidimentional Raster Analysis	**4**
11	Hyperspectral Analysis and Interpretaion	**4**
12	SAR Data Analysis and Interpretaion	**4**
13	LIDAR Data Analysis and Interpretaion	**4**
14	Thermal Image Analysis: Calculating surface temperature using thermal imagery	**4**

REFERENCES:

1. Lyon, J.G (2003) GIS for Water Resources and Watershed Management. Taylor and Francis, New York.
2. Colin W.Mitchell (1991) Land Evaluation, Longman scientific& Technical, co published with John Wiley & sons Inc, New York.
3. Burrough, P.A. (1986). Principles of Geographical Information Systems for Land Resource Assessment, Clarendon Press, Oxford, New York.

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1. https://www.l3harrisgeospatial.com/docs/hyperspectralanalysistutorial.html
2. http://home.iitk.ac.in/~blohani/LiDARSchool2008/Downloads/Lab_Manual_LiDAR_School_Book2.pdf
3. https://www.gislounge.com/how-to-use-arcgis-pro-to-calculate-land-surface-temperature-lst-from-landsat-imagery/
4. http://gis.humboldt.edu/OLM/Courses/GSP_510/10%20MidSemesterReview/Lab_Practical.html

COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Field Visit, Experimental Learning
CD4	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

PRACTICAL-06: PROGRAMMING FOR GIS

Course Type	Course Code	Teaching Hours	Credits	L	T	P	C
Practical	PRACT 06	56		0	0	4	2

Pre-requisite(s): No Pre-requisite(s)

Course Objectives:

This course aims to:

1.	Integrate programming with GIS analysis
2.	introduce the fundamentals of programming in GIS using Python language
3.	Introduce arcpy and how this can be used to automate and extend geoprocessing tasks.
4.	Facilitate classroom instruction for the analysis of geospatial data using Python.

Course Outcomes (CO):

After the completion of this course, students should be able to:

CO1	Produce basic Python code that is functional and extendable.
CO2	Undertake basic geoprocessing tasks by using Python code and the arcpy library.
CO3	Package code into usable Python Toolboxes that will be available to users via ArcToolbox.
CO4	Perform map designing using Python scripting.

SYLLABUS

Lab No	Topics	Lectures
1	Working with Python editors & using IDEs for ArcGIS Desktop 10.x.	**4**
2	Geoprocessing using Python scripting (Clip, Split By Attributes, Buffer).	**4**
3	Exploring spatial data using Python: (Checking, Describing, & Listing data).	**6**
4	Debugging and error handling in Python.	**6**
5	Manipulating spatial and tabular data using Python.	**6**
6	Working with Geometries using Python.	**4**
7	Working with rasters using Python.	**4**
8	Map scripting & Map Designing using Python.	**4**
9	Spectral indices and transformations in Google Earth Engine.	**4**
10	ArcGIS Dashboard for Public Health Informatics.	**4**
11	ArcGIS Online	**4**
12	Mobile GIS	**4**

REFERENCES:

1. Paul A. Zandbergen (2020) Python Scripting for ArcGIS Pro, ESRI Press.

2. Paul A. Zandbergen (2020) Advanced Python Scripting for ArcGIS Pro, ESRI Press.
3. Eric Pimpler (2015). Programming ArcGIS with Python Cookbook, Packt Publishing Limited; 2nd edition.
4. Laura Tateosian (2018). Python For ArcGIS. Springer.
5. Silas Toms, and Dara O'Beirne (2017). ArcPy and ArcGIS -: Automating ArcGIS for Desktop and ArcGIS Online with Python, Packt Publishing Limited; 2nd edition.

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2. https://www.esri.com/en-us/arcgis/products/arcgis-python-libraries/overview
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COURSE EVALUATION:

Individual assignment, Theory (Quiz, Mid and End semester) Examinations

COURSE DELIVERY METHOD:

CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Field Visit, Experimental Learning
CD4	Laboratory experiments/teaching aids

MAPPING BETWEEN CO AND PO					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1					
CO2					
CO3					
CO4					

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN CO AND CDM	
CO	**Course Delivery Method**
CO1	CD1
CO2	CD1,CD3
CO3	CD1, CD2, CD4
CO4	CD1, CD2, CD4, CD5

Semester Four

Accepts of method validation: observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with static package (Sigma STAT, SPSS for student t-test, ANOVA, etc.), hypothesis testing.

DISSERTATION

Course Type	Marks	Credits	L	T	P	C
Project	300					12

The student shall carryout, a semester long project work under the supervision/mentorship of identified guide (internal or external or both). The project work shall be compiled and submitted in the form of dissertation as per the format. The project work shall be original research work related to the programme or case studies that provide an analysis of specific research questions/socio-economic issues, etc. leading to a dissertation as partial fulfilment of the degree.

Question Paper Pattern

MODEL QUESTION PAPER **QP CODE:**

JSS Academy of Higher Education & Research, Mysuru
(Deemed to be University)
First Semester M.Sc., (Program) (RS-1) Examination - Year
Subject:

Note: *Draw neat, labeled diagrams wherever necessary.*
Your answers should be specific to the questions asked.

Time: 03 Hours **Max Marks: 70**

I. LONG ESSAYS (Answer any TWO of the following) **2x15=30 Marks**

1.
2.
3.

II. SHORT ESSAYS (Answer any FIVE of the following) **5x6=30 Marks**

4.
5.
6.
7.
8.
9.
10.

III. SHORT ANSWERS (Answer all the following) **5x2=10 Marks**

11.
12.
13.
14.
15.

*****

MODEL QUESTION PAPER **QP CODE:**

JSS Academy of Higher Education & Research, Mysuru

(Deemed to be University)

First Semester M.Sc., (Program) (RS-1) Examination - Year

Subject:

Note: *Draw neat, labeled diagrams wherever necessary.*

Your answers should be specific to the questions asked.

Time: 02 Hours **Max Marks: 50**

I LONG ESSAYS (Answer any TWO of the following) **2x10=20 Marks**

1.
2.
3.

II SHORT ESSAYS (Answer any FIVE of the following) **5x4=20 Marks**

4.
5.
6.
7.
8.
9.
10.

III SHORT ANSWERS (Answer all the following) **5x2=10 Marks**

11.
12.
13.
14.
15.

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